Special Inside: Preview of the NC Conference & Show

NORTH CAROLINA Turfgrass

November/December 2006

A Publication of the Turfgrass Council of North Carolina

Update on Water-Quality Issues for Golf Courses in North Carolina

The Importance of Plant Tissue Analysis in Turf Management

Highlights from NCSU's Turfgrass Research Field Day

Turfgrass Council of North Carolina
P.O. Box 2163
Cary, NC 27512-2163
ADDRESS SERVICE REQUESTED

green light ON BASICS

THE IMPORTANCE OF PLANT TISSUE ANALYSIS IN TURFGRASS MANAGEMENT

By Mike Allen, NCDA&CS Agronomic Division

North Carolina has more than two million acres of turfgrass that provide the foundation for many recreational activities and aesthetic landscapes. In 2004, NC Cooperative Extension reported that our state ranked eighth in the U.S. in total turf acreage and ninth in total turf acreage on golf courses. Maintaining turf's value and beauty requires optimal fertilization, and plant tissue analysis is the ideal tool for this task.

Turfgrass is a high-value, intensively managed public commodity. For good economic sense and responsible stewardship, its fertilization should be cost effective, agronomically sound and environmentally safe. Cookbook approaches and guesswork do not meet these criteria. Although soil testing is very important for long-range planning of a turf fertility program, it cannot capture the whole picture regarding nutrient needs. Tissue analysis has the advantage of being able to give a quick snapshot of the nutritional status of turf — not just the levels present in the soil. This feedback enables managers to adjust fertilization in a precise and timely manner.

The NC Department of Agriculture and Consumer Services (NCDA&CS) is one of the most accessible and inexpensive providers of plant tissue analysis. Within two working days, the NCDA&CS Agronomic Division can chemically analyze turf clippings to measure concentrations of 11 essential plant nutrients (nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, zinc, copper and boron) plus sodium.

Be forewarned, however — although tissue testing is a good way to monitor nutrient needs or to diagnose suspected nutrient problems, it does not identify disease or insect problems. Any turf problems that may be due to disease or insects should be referred to the local county Cooperation Extension office or NC State University's Plant Disease and Insect Clinic (PDIC). Consulting with Cooperative Extension first is advised, since local agents will be able to diagnose many problems. If samples need to be sent to the PDIC, sample submission through the county Extension office will usually result in a lower fee, particularly for NC residential turf samples.

Predictive analysis — monitoring nutrient needs

Routine tissue testing involves collecting samples from apparently healthy turf at regular intervals throughout the growing season. The aim is to adjust fertilization precisely to meet actual needs. Tissue analysis can identify nutritional problems up to two weeks before symptoms appear, thus providing opportunity for quick and efficient corrective action.

Even if nutrients have been applied in adequate amounts to turf, several factors can lessen their availability. In coarse, well-drained soils, sulfur, nitrogen, potassium and magnesium can leach out of the rootzone due to irrigation and rainfall. Tissue analysis indicates if sufficient nutrients are being taken up or if additional fertilizer is needed.

For example, in fiscal year 2006, only 12 percent (63 out of 524) of the bentgrass samples tested at the NCDA&CS laboratory contained sufficient potassium. The concentration was low in 44 percent of the samples and already deficient in another 44 percent. Timely correction of insufficient potassium is critical for optimum growth and development. Adequate potassium improves cold-weather tolerance, protects against infection by root-rotting organisms and promotes good water status.

Routine testing is most profitable for high-value, intensively managed areas such as golf courses, sod farms and athletic fields. Fine-tuning a fertilizer program can greatly improve turf quality. For municipal, industrial, commercial and residential turf, plant tissue analysis is most commonly used to troubleshoot suspected nutrient problems.

Diagnostic analysis — lidentifying nutrient problems

Tissue testing, in conjunction with matching soil samples, is the definitive way to find out if discolored or poorly growing areas have an underlying nutrient problem. For problem diagnosis, NCDA&CS recommends submitting two separate tissue samples (one from an area that is growing well and one from the problem area) and two corresponding soil samples from the rootzones of the poor and the healthy turf.

Comparison of "good" and "bad" samples sheds light on whether factors such as insect and disease damage, mechanical injury or drought stress are contributing to the observed problem. By being able to compare soil and tissue test results, NCDA&CS agronomists have better insight into why nutrient levels may be high or low. Soil samples provide valuable information on soil nutrient availability, pH and soluble salts.

Collecting and handling tissue samples

For accurate analysis, grass clippings must be free of contaminants. There should be no tree leaves, pine needles or other debris in the tissue sample. Avoid sampling areas that have been topdressed, fertilized or treated with a pesticide within the week prior to sampling. If this is unavoidable, note the situation on the *Plant Sample Information* sheet.

For routine nutrient monitoring, collect clippings randomly from the total area of interest, thoroughly mix and then remove about two handfuls for the sample. Tissue samples of low-growing grasses can be collected straight from the mower bag or basket. For taller-growing grasses, clip the upper third of the leaf tissue. One pint of clippings makes a good sample. When submitting samples for problem diagnosis, remember to collect separate tissue samples from the problem area and a normal area.

It is a good idea to collect tissue samples prior to any scheduled fertilization dates. For instance, a general recommendation for cool-season residential lawns is to apply fertilizer in September, November and February. Sampling just prior to those months makes it possible to select the most appropriate fertilizer and rate.

Tissue samples being collected from clippings in a mower bag.

Packaging samples

Moisture can ruin tissue samples. Let clippings air-dry before packaging. Use paper containers like lunch bags or the tissue sample envelopes provided by the NCDA&CS Agronomic Division. Never place turfgrass samples in plastic containers. Plastic traps moisture and accelerates deterioration of the sample, which can affect the lab results.

When several individual samples are collected, place all the sample bags or envelopes loosely in a larger container clearly addressed to the Plant/Waste/Solution Section of the Agronomic Division. If matching diagnostic soil samples are being sent in the same container, package them so they cannot contaminate the plant tissue and be sure to include a completed Diagnostic *Soil Sample Information* sheet (form AD-2).

Tissue samples must be submitted with a *Plant Sample Information* sheet (form AD4) and the appropriate processing fee. The information sheet serves as the primary source of information about the samples. Fill it out as completely as possible, being sure to provide details on cultural history, appearance, problems and any other types of matching samples submitted. Information sheets are available online from the NCDA&CS Agronomic Division website, as well as from all county Cooperative Extension offices.

The standard fee for NCDA&CS tissue analysis is $5 per sample for NC residents. Analysis of samples from out of state costs $25 per sample. Laboratory results are mailed to customers and posted online. Although at the present time only results for in-state samples are available online, out-of-state customers can request that their reports be emailed to them.

Tissue analysis results

Laboratory analysis of plant tissue requires two working days. Concentrations of primary (N, P, K) and secondary (Ca, Mg, S) nutrients are reported as percentages; micronutrient (Fe, Mn, Zn, Cu, B) concentrations are reported in parts per million (ppm). For ease of interpretation, nutrient measurements are also presented as index values.

Nutrient index values range from 0 to 124 and are divided into five categories (Figure 1). A value of 50 to 74 indicates that the nutrient concentration is *sufficient for optimum growth*, yield and quality. Index values in the low range (25–49) indicate that growth or quality may be depressed because too little of an element is present. The critical value indicates the point at which a nutrient shortage causes a 5- to 10-percent loss in yield or growth (Figure 1). Within the deficient range (0–24), growth is severely depressed by a shortage of the nutrient. In cases where the index value is below the desired levels, supplying the indicated nutrient under favorable environmental conditions and at the proper growth stage usually results in increased growth, quality and/or yield (Table 1). High values (75–99) indicate that nutrient levels are more than adequate and that luxury consumption may be occurring, while index values of 100 or greater indicate that yield or quality may be depressed by an excess of a nutrient. The point of mild toxicity indicates the point at which excess of a nutrient may cause a 5- to 10-percent loss in yield or growth (Figure 1).

In addition to sufficient quantities of essential elements being present in plant tissue, there also needs to be the right proportion of nutrients. The N:S, N:K and Fe:Mn ratios listed on the report indicate degree of balance among some essential elements. For example, a N:S ratio in the range of 10:1 is optimal for assimilation of nitrogen and sulfur in most turfgrasses.

Turf tissue samples at the NCDA&CS Agronomic Division laboratory.

FIGURE 1. Nutrient index interpretation scale.

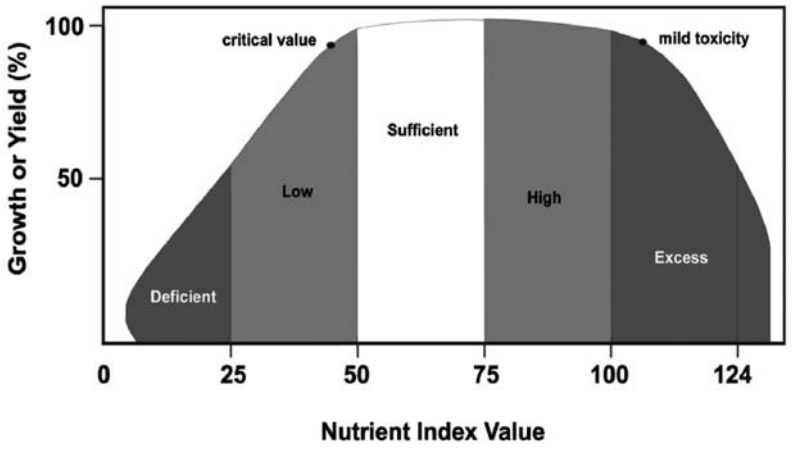

TABLE 1. Expected response to nutrient applications.

Index	Interpre-tation	Crop Response
0-24	deficient	high
25-49	low	medium
50-74	sufficient	low
75-99	high	none
100-124+	excess	none

TABLE 2. Sufficiency ranges for bentgrass and bermudagrass greens in the Southeast.

Nutrient	Bentgrass	Bermudagrass
Nitrogen (N), %	4.0-5.0	3.0-4.0
Phosphorus (P), %	0.3-0.6	0.2-0.4
Potassium (K), %	2.25-3.5	1.8-2.25
Calcium (Ca), %	0.25-0.75	0.25-0.50
Magnesium (Mg), %	0.2-0.4	0.15-0.30
Sulfur (S), %	0.2-1.0	0.15-0.65
Zinc (Zn), ppm	20-70	15-70
Copper (Cu), ppm	5-15	5-20
Manganese (Mn),ppm	25-300	20-300
Iron (Fe), ppm	50-300	50-250
Boron (B), ppm	3.5-20	5-15

Sufficiency ranges

Guidelines for interpretation of analytical results are based on years of research, surveys and experience. Table 2 provides the ideal nutrient concentrations for bentgrass and bermudagrass in the Southeast. These concentrations correspond to the *sufficient* range (50–75) on the index scale.

Responsible land stewardship

Plant tissue analysis is a useful tool for avoiding environmental damage due to excess nutrient loading. Turfgrass responds to the addition of nutrients only until optimum growth or yield is achieved. After that point, the efficiency of fertilization decreases. Nutrients that are not taken up accumulate in the soil or move into ground or surface water. Fertilization at agronomic rates based on tissue test results reduces this risk.

Using plant tissue analysis as a fertility management tool results in healthier, greener grass. On top of that, it is cost effective and environmentally sound. Sometimes the grass is greener on the other side for a reason!

Contacting the NCDA&CS Agronomic Division

Information on collecting or submitting tissue samples is available online at the NCDA&CS Agronomic Division website at www.ncagr.com/agronomi/. For additional help, call the division office at (919) 733-2655, or contact the NCDA&CS regional agronomist assigned to your county. A list of regional agronomists and their service areas can be found at www.ncagr.com/agronomi/rahome.htm.